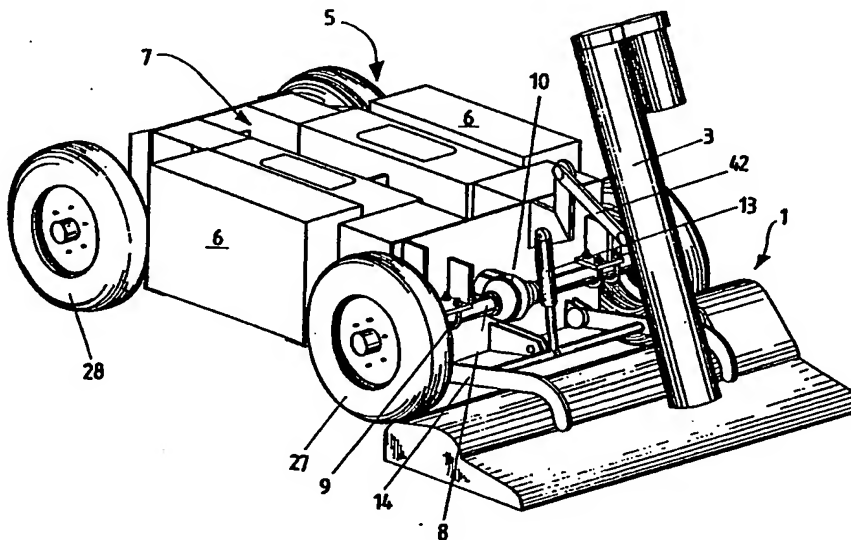




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : E01H 4/02	A1	(11) International Publication Number: WO 94/10393 (43) International Publication Date: 11 May 1994 (11.05.94)
(21) International Application Number: PCT/FI93/00441 (22) International Filing Date: 28 October 1993 (28.10.93) (30) Priority data: 924906 29 October 1992 (29.10.92) FI 931862 26 April 1993 (26.04.93) FI (71) Applicant (for all designated States except US): OY MAR-EXTEAM LTD [FI/FI]; Ahjokatu 13, FIN-40320 Jyväskylä (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): LEHTONEN, Jorma [FI/FI]; Nujulantie 6, FIN-40420 Jyskä (FI). LINTUNEN, Veikko [FI/FI]; Revontie 5 B 7, FIN-40250 Jyväskylä (FI). SAUNISTO, Kimmo [FI/FI]; Koivukatu 8 B, FIN-41160 Tikkakoski (FI).		(74) Agent: HELKE, Kimmo; Kespat Oy, P.O. Box 601, FIN-40101 Jyväskylä (FI). (81) Designated States: CA, SE, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report. In English translation (filed in Finnish).

(54) Title: ICE RINK RESURFACING MACHINE



(57) Abstract

The object of the invention is an ice-maintenance machine, which includes a steerable vehicle (2), a water tank (15, 16), a platform (4) for icy slush, an ice-maintenance unit (1) propelled by the vehicle, and a removal conveyor (3) for transferring the icy slush from the ice machining unit (1) to the platform (4) and in which the vehicle (2) includes a chassis (5), front and rear axles (8, 11) with wheels (27, 28), a motor (24), and transmission devices connected to the axles including a cardan axle (22) between them and a distribution gearbox (23). A low structure is achieved when the chassis (5) is formed of a box structure, which itself forms the water tank (15, 16), and that the centre of the chassis includes a longitudinal channel (7) for the cardan axle (22) and the distribution gearbox (23).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LJ	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TC	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UZ	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

ICE RINK RESURFACING MACHINE.

The object of the invention is an ice-maintenance machine, which includes a steerable vehicle, a water tank, a platform for icy slush, an ice-maintenance unit propelled by the vehicle, and a removal conveyor for transferring the icy slush from the ice machining unit to the platform, and in which the vehicle includes a chassis, front and rear axles with wheels, a motor, and transmission devices connected to the axles including a cardan axle between them and a distribution gearbox.

Ice-maintenance machines are presented in US patent publications numbers 3,044,193, 3,622,205, and 3,705,746. Nearly all present ice-maintenance machines utilize a combustion motor-driven vehicle, which is constructed on a separate beam chassis, which carries a separate water tank, a platform for icy slush, and a motor and transmission. The construction reaches a considerable height, which is not advantageous from the point of view of the operability of the device.

The intention of this invention is to create a new kind of ice-maintenance machine, which makes possible a lower total structure than previously. The characteristic features of an ice-maintenance machine in accordance with the invention are presented in the accompanying Patent Claims. When the chassis is formed by a box construction, and the transmission is adapted to the same level as the chassis, there is a considerable saving in overall height, when at the same time the box construction forms the water tank required by the ice-maintenance machine. The transmission channel can naturally also be a tunnel-like space, but an open channel is more advantageous from the point of view of installation and maintenance.

Other forms of application and advantages of the invention become apparent later in connection with the example of execution.

In what follows the invention is illustrated by reference to the accompanying Figures, which show one ice-maintenance machine in accordance with the invention and its chassis construction together with the transmission.

5

Figure 1 shows the ice-maintenance machine seen from the side.

Figure 2 shows the ice-maintenance machine seen from above.

10 Figure 3 shows an axonometric view of the chassis of the ice-maintenance machine, the transmission, and the ice-maintenance unit.

Figure 4 shows the chassis and transmission of the ice-maintenance machine seen from the side and in-cross-section at the transmission channel.

15

Figure 5 shows the chassis and transmission seen from above.

In accordance with Figures 1 and 2 the ice-maintenance machine includes a steerable vehicle 2, to which an ice-maintenance unit 1 is attached by means of carrier arm 14. The vehicle 2 includes chassis 5, battery bank 6, and snow platform 4, which in normal operation is covered by cover 26. The ice-machining unit 1 is connected to the opening of the snow reservoir 4 by means of a removal conveyor 3 in what is as such a known method. The cab 25 of the vehicle includes the control devices for the ice-machining unit 1. Due to the traction resistance of the ice-machining unit 1, both the front and rear wheels 27 and 28 of the steerable vehicle 2 are driven, while the front wheels 28 turn in a manner that is in itself known. It is advantageous if the vehicle is electrically powered, when the exhaust emissions of a combustion motor are avoided. Because the operating area is very limited, it is possible to use electrical supply by means of a 3-phase cable, either as an alternative to the above-mentioned battery bank, or in addition to it.

35

Figure 3 shows the basic construction of the device schematically, without the platform, cab, or cover. The box chassis 5 is

shown later in greater detail, but Figure 3 shows the channel 7 is the centre of the chassis, in which the cardan axle between the axles and the rest of the transmission is located. The ice-maintenance unit 1 is suspended from the chassis by means of arms 14 and is pressed against the ice by means of cylinder 13. Removal conveyor 3, which is supported from the chassis by means of arm 42, is used to transfer the icy slush from the ice-maintenance unit 1 to the platform. Figure 3 shows the rigid attachment of the rear axle 8 to the chassis. Both axles, as in this case the rear axle 8, have a bevel gearbox 10, equipped with a differential gear, rigidly attached to them.

The front axle, which includes a turning mechanism, is suspended by means of swing bracket 19, which is in turn jointed to chassis 5 by means of longitudinal axle 20. By means of this, the vehicle is able to absorb small unevennesses, such as thresholds, etc.. The rear axle 8 is attached to the chassis flanges by U-bolts 9 and the front axle 11 correspondingly to the swing bracket 19 by U-bolts 21.

The box construction of chassis 5 consists of two side boxes 15 and of a narrower connecting box 16 between them beneath the transmission channel 7. In addition, the six boxes 15 have common end plates 17 and 18, in which operational openings, for among other things bevel gears 10 and 12, are formed next to the channel 7.

Flanges 37, 38, and 39 are welded onto the end plates 7 of chassis 5 in order to carry the ice-maintenance unit and other auxilliary equipment. In addition, the end plates include flanges for the rear axle and the jointing of the platform.

The motor 24 and the distribution gearbox 23 are also advantageously placed in the transmission channel 7. The motor 24 is supported on a flange welded to the chassis, but the distribution gearbox 23 is supported directly by the bevel gearbox 10 belonging to the rear axle 8. After this only a moment support from the distribution gearbox is required to the

chassis 5. The distribution gearbox 23 and the motor 24 are connected by jointed axle 29 and the distribution gearbox 23 is connected to the bevel gear 12 of the front axle 11 by means of jointed arm 22. In addition the transmission includes motor revolution speed sensor devices and a parking brake, which are not separately shown here.

Figure 5 shows the chassis structure without the battery bank. The battery bank is suspended from supports 32, which are welded to the sides of the frame. The front axle 11 includes intermediate arm 29, which is operated by a hydraulic cylinder from a protrusion arranged on the right-hand side of the swing bracket. A schematic intermediate arm 29 and a hydraulic cylinder 30 for operating it are drawn in Figure 4.

15

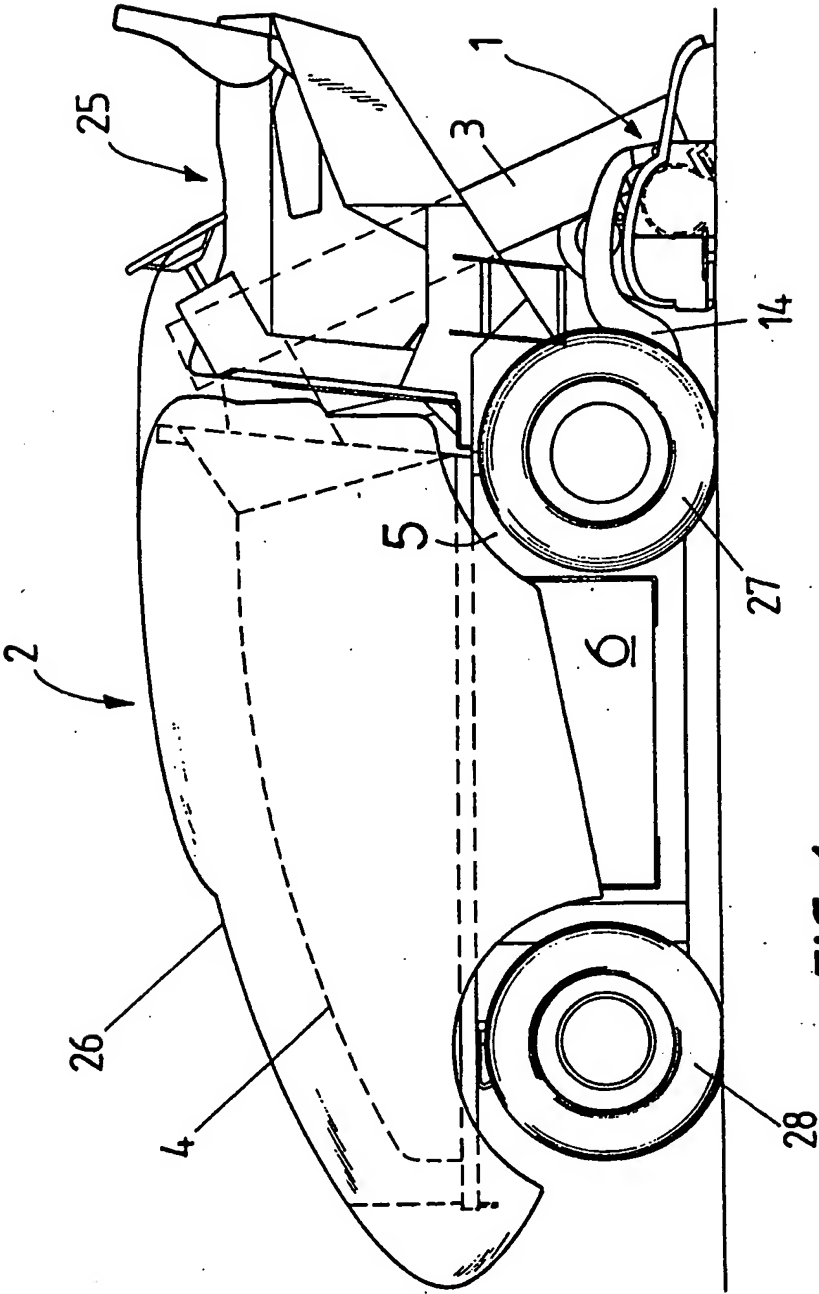
The water tank includes maintenance manholes 33, a filler pipe 35, a replacement air pipe 36, and a drainpipe 34 (in Figure 4). Inside the water tank it is advantageous to use a submersion pump, which is not separately shown here.

Patent Claims

1. An ice-maintenance machine, which includes a steerable vehicle (2), a water tank (15, 16), a platform (4) for icy slush, an ice-maintenance unit (1) propelled by the vehicle, and a removal conveyor (3) for transferring the icy slush from the ice machining unit (1) to the platform (4), and in which the vehicle (2) includes a chassis (5), front and rear axles (8, 11) with wheels (27, 28), a motor (24), and transmission devices connected to the axles including a cardan axle (22) between them and a distribution gearbox (23), characterized in that
- the chassis (5) is formed of a box structure, which itself forms the water tank (15, 16), and that
 - the centre of the chassis includes a longitudinal channel (7) for the cardan axle (22) and the distribution gearbox (23).
2. An ice-maintenance machine in accordance with Patent Claim 1, characterized in that the motor (24) is an electric motor, which is located on top of the cardan axle (22) in the same channel (7).
3. An ice-maintenance machine in accordance with Patent Claim 2, characterized in that the battery bank (6) is located equally on both sides of the chassis (5).
4. An ice-maintenance machine in accordance with Patent Claim 1, characterized in that the transmission devices include bevel gears (10, 12) equipped with differential gearing between the cardan axle and the axles (8, 11).
5. An ice-maintenance machine in accordance with Patent Claim 4, characterized in that one axle (8) with its bevel gears (10, 12) is rigidly attached to the chassis (5) and the opposite axle (11) is suspended by means of a swing bracket (19), which is jointed through a longitudinal axle (20) to the chassis (5).

6. An ice-maintenance machine is accordance with Patent Claim 5, characterized in that the bevel gearbox (10) of the rigidly attached axle (8) is arranged to carry the distribution gearbox (23), which is only supported by the chassis (5) is
5 order to cancel torque.

7. An ice-maintenance machine in accordance with any of Patent Claims 1 - 6, characterized in that the chassis (5) consists of two unified side boxes (15), a connecting box (16)
10 between them beneath the transmission channel (7), common end plates (17, 18) at the front and rear also covering the area of the transmission channel (7) except for operational openings.



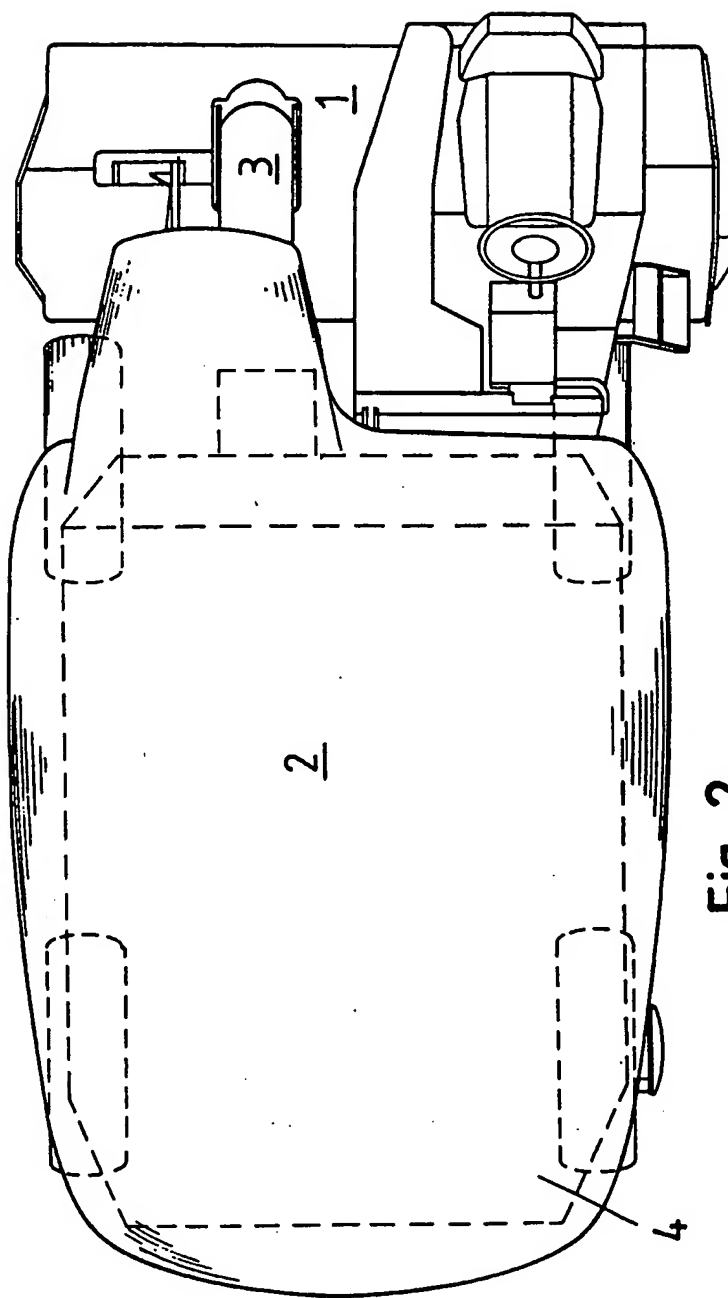


Fig. 2

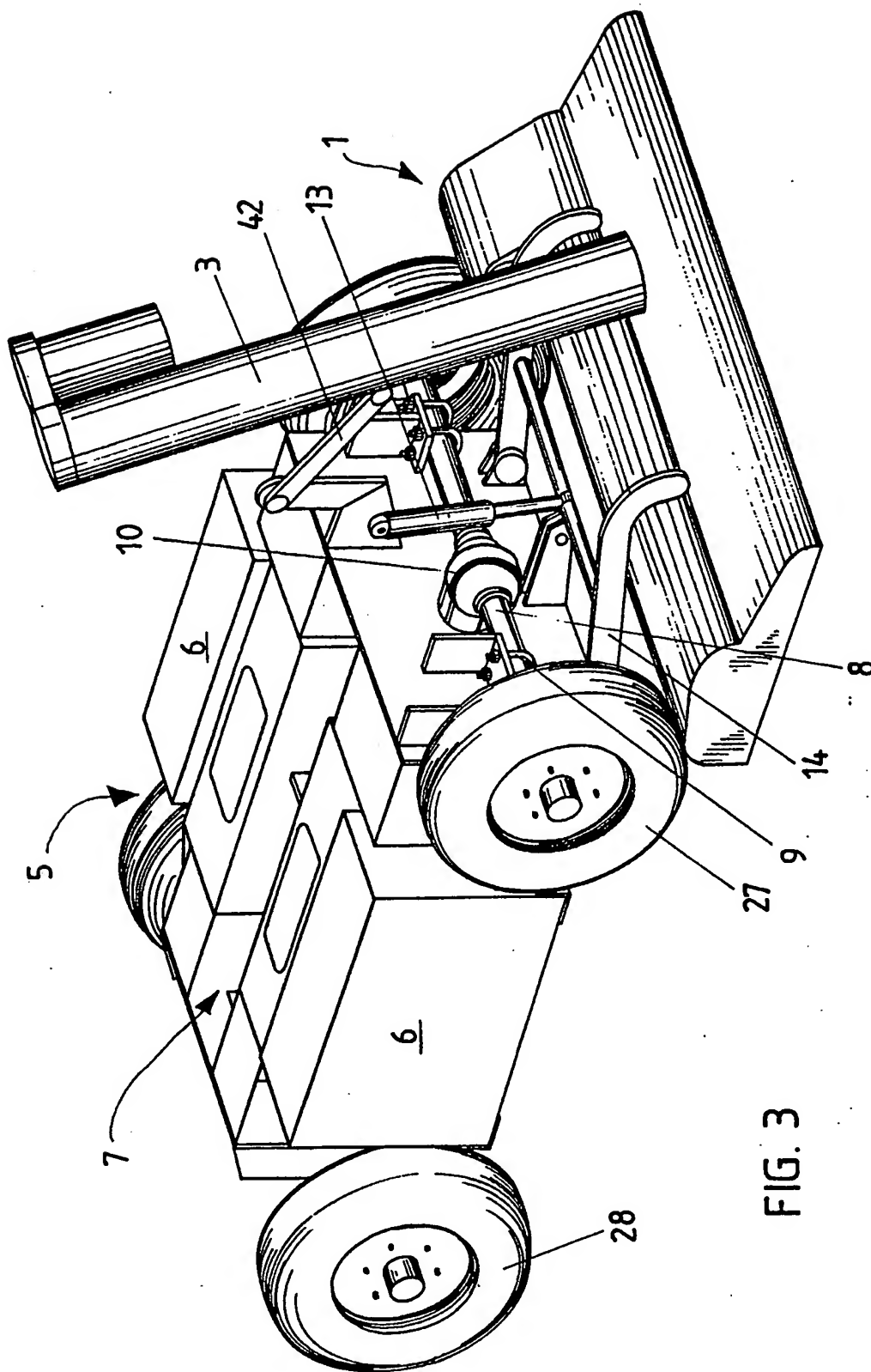


FIG. 3

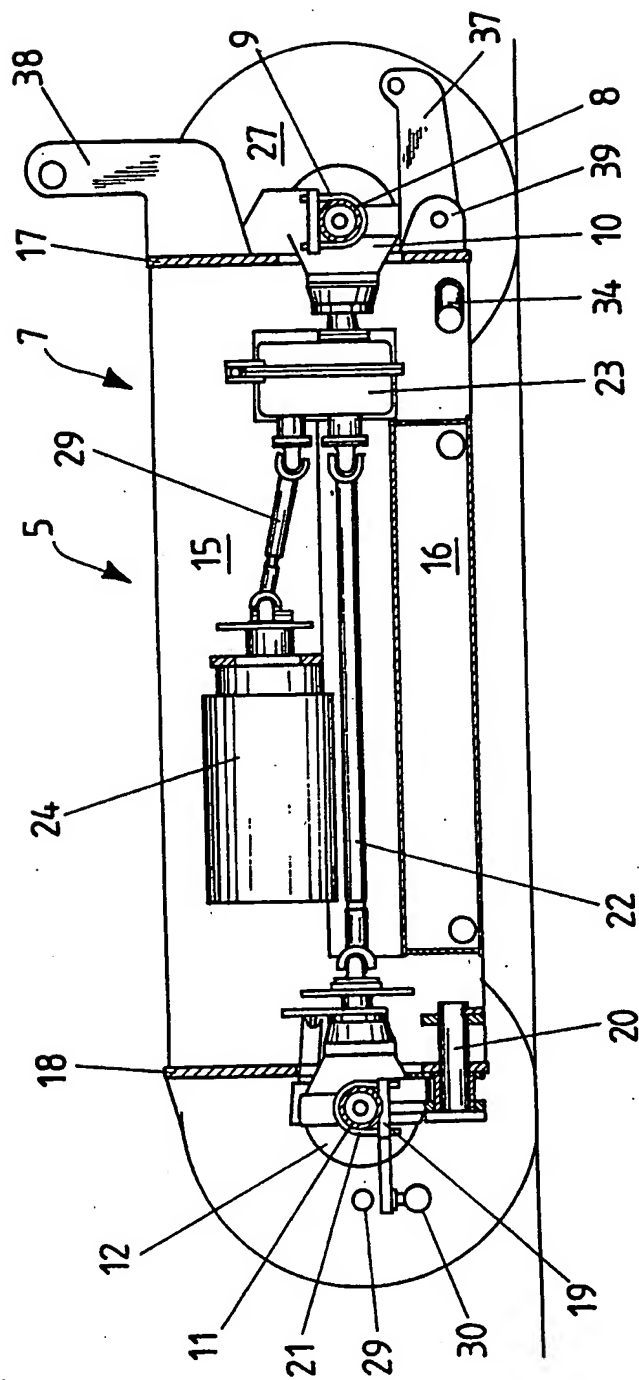


FIG. 4

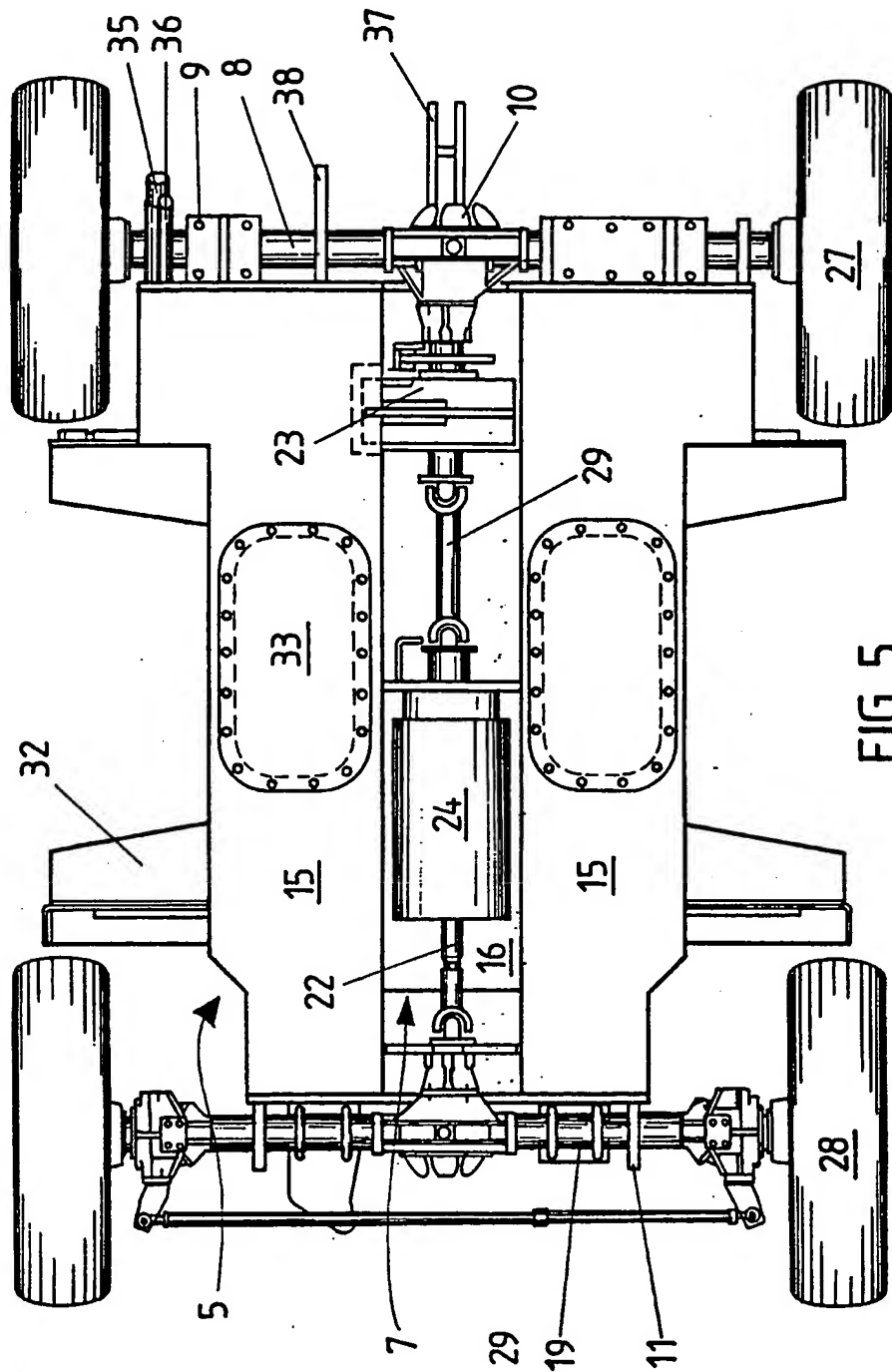


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 93/00441

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: E01H 4/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: E01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 2642679 (F.J. ZAMBONI), 23 June 1953 (23.06.53), the whole document --	1-7
A	US, A, 3622205 (F.J. ZAMBONI), 23 November 1971 (23.11.71), the whole document --	1-7
A	US, A, 3705746 (S.R. MCLEOD), 12 December 1972 (12.12.72), the whole document -----	1-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

21 January 1994

Date of mailing of the international search report

02 -02- 1994

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Johan Löfstedt
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

27/11/93

International application No.

PCT/FI 93/00441

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 2642679	23/06/53	CH-A- 319606 DE-B- 1096261 GB-A- 722880	00/00/00 00/00/00 00/00/00
US-A- 3622205	23/11/71	DE-A- 2130563 FR-A- 2097992 SE-B,C- 387247	20/01/72 03/03/72 06/09/76
US-A- 3705746	12/12/72	CA-A- 926117	15/05/73